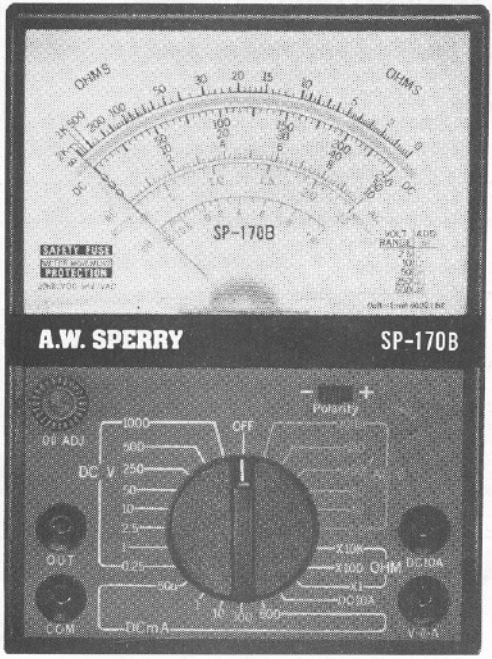
OPERATING INSTRUCTIONS

Model SP-170B

38 RANGE GENERAL PURPOSE PORTABLE ANALOG MULTIMETER



PLEASE READ THESE OPERATING INSTRUCTIONS CAREFULLY

Misuse and or abuse of these instruments cannot be prevented by any printed word and may cause injury and or equipment damage. Please follow all these instructions and measurement procedures faithfully and adhere to all standard industry safety rules and practices.

A.W. SPERRY INSTRUMENTS INC.

245 MARCUS BLVD., HAUPPAUGE, NEW YORK 11788
Phone: 800-645-5398 Toll Free (N.Y. and Alaska call collect 516-231-7050)
Fax: 516-434-3128 Telex: 645104 SPERRYINC HAUP

CONTENTS

ONE YEAR LIMITED WARRANTY

A.W. Sperry Instruments, Inc., warrants that this AWS instrument has been carefully tested, inspected, and warranted for one (1) year from the date of purchase by the original end user, provided the completed warranty card is returned within ten (10) days after purchase and the instrument has not been misused, damaged due to negligence, neglect or unauthorized repair, abused or used contrary to the operating instructions. Instruments and proof of purchase in the form of a legible copy or original of the sales receipt clearly identifying the distributor, model number and date of purchase must be returned to A.W. Sperry Instruments Inc., Attention: Customer Service Center, 245 Marcus Boulevard, Hauppauge, New York 11788, postage prepaid for examination and verification of manufacturing defect under warranty. A.W. Sperry Instruments Inc., shall be the sole judge of such defect. The liability of A.W. Sperry Instruments Inc., shall be limited to the repair or replacement at its sole option of any defective product.

THIS WARRANTY AND THE OBLIGATIONS AND LIABILITIES OF SELLER THEREUNDER ARE EXCLUSIVE AND IN LIEU OF AND BUYER HEREBY WAIVES ALL OTHER REMEDIES, EXPRESS WARRANTIES, GUARANTIES OR LIABILITIES, OF AND FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OR WHETHER OR NOT OCCASIONED BY SELLER'S NEGLIGENCE. THIS WARRANTY SHALL NOT BE EXTENDED, ALTERED OR VARIED EXCEPT BY A WRITTEN INSTRUMENT SIGNED BY SELLER AND BUYER. SOME STATES ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIED LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

WARRANTY REGISTRATION

To validate warranty, please complete the warranty registration card enclosed with your instrument and return to A.W. Sperry Instruments Inc., 245 Marcus Blvd., Hauppauge, N.Y. 11788 within 10 days of purchase. No postage required.

WARRANTY RETURN

Refer to section "Return for Repairs" for complete instructions. All warranty returns must include a legible copy or original of the sales receipt clearly identifying the model number, serial number and date of purchase.

Sec. 1 DESCRIPTION

Congratulations on your purchase of an AWS SP-170B Analog Multimeter.

The SP-170B is the latest version of the SP-170 Series, a time honored classic in the instrumentation field. The SP-170 Series has been proven by many years of service to be outstanding in its reliability, performance and value. It's an instrument that can be depended on to consistently give accurate measurements and stand up to the rigors of heavy duty field use.

With the capacity of reading 7 functions on up to 38 popular ranges this multimeter offers a powerhouse of measurement capability in one, self-contained housing. When combined with its optional accessories, the SP-170B enables you to easily handle your continuously changing needs. Designed for the professional at work in the field or in the laboratory, the SP-170B is also simple enough to use for the hobbyist at home.

Safety was a prime consideration in the design of this instrument. Housed in shock resistant ABS plastic, this instrument will stand up to the use and abuse of everyday service, and also electrically insulates the user from shock hazards.

With proper care the SP-170B will give you many years of useful service.

Sec. 2 FEATURES

- ***38 Popular Ranges***
- ***+DC, -DC Switch for DC Voltage and Current***
- ***24 Position "Positive Action" Selector Switch with an "OFF" Position***
- ***Rugged ABS Plastic Housing***
- ***Mirrored Scale - Eliminates Reading Errors Due to Parallax.***
- ***Two Color Scale Plate***
- ***Color Keyed Front Panel***
- ***Diode Protected Meter Movement***
- ***Large Optically Clear Window - Eliminates Distortion***
- ***Industry Standard Safety Recessed Input Terminals and Shielded Banana Plugs***
- ***Separate 10A Terminal***
- ***Separate Output Terminal***
- ***Built-in Tilt Stand***

Sec. 3 SPECIFICATIONS

RANGES:	
AC Voltage:	2.5/10/50/250/500/1000Vac
DC Voltage:	0.25/1/2.5/10/50/250/500/1000Vdc
DC Current:	50μA/1m/10m/100m/500mA/10Adc
Resistance:	2K/200K/20MΩ (15Ω/1.5K/15KΩ mid scale)
Decibels:	-20 to +56dB
ACCURACY:	
DC:	±3% Full Scale
AC:	±4% Full Scale
Resistance:	±3% Arc Length
SENSITIVITY:	20KΩ/VDC, 5KΩ/VAC
POWER SOURCE:	Two (2) "AA" 1.5V type batteries, AWS Part# B-1. One (1) 9V "Transistor" type (NEDA #1604), AWS Part #B-4.
FUSE:	One (1) installed, one (1) spare, Glass instrument Type 1/2A, 250V, 6.35mm x 30mm Fast acting Fuse, AWS Part #F-18 or approved equivalent.
SIZE:	4.9"W x 6.7"H x 2"D, (125mm x 170mm x 50mm)
WEIGHT:	Approximately 17.0 oz. (480 g).

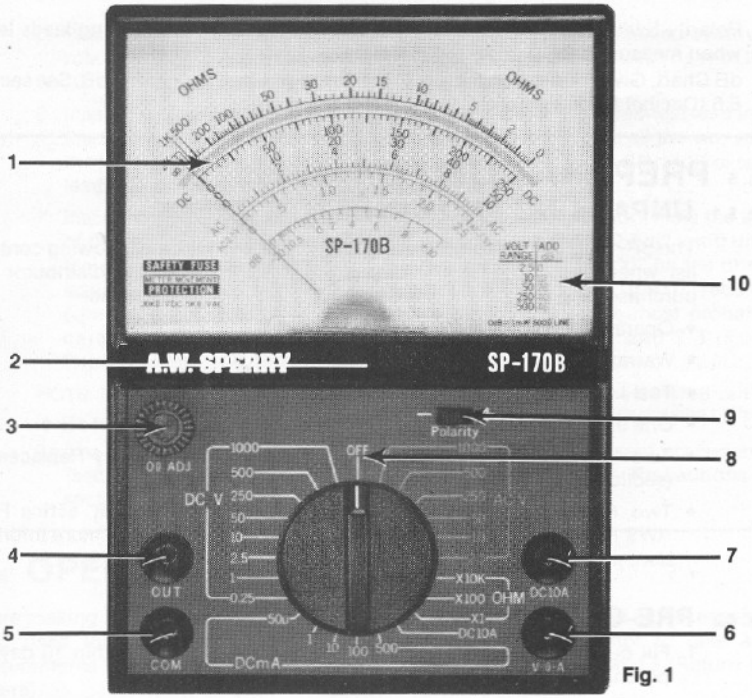


Fig. 1

Sec. 4 FRONT PANEL CONTROLS AND INDICATORS (See Fig. 1)

1. Mirrored scale: Takes the guess work out of all measurements, eliminates Parallax errors.
2. Zero Adjust: Adjusts movement pointer to zero position with no input.
3. OHM adjustment: Zero's out movement on resistance ranges when leads are shorted together. See section 6.5 (Resistance Measurements), for more information.
4. "Out" Terminal: Use to sample signal being measured or when taking dB measurements.
5. "–" Terminal: Insert black lead for all measurements.
6. "+" Terminal: Insert red lead when taking V-Ω-mA measurements (except 10ADC, and dB).
7. 10Adc Terminal: Insert red lead for measurements up to 10Adc. See section 6.4 (DC Current Measurements), for more information.
8. "OFF" Position: Provides a "shunt" across the meter for protection of the movement during transportation, also prevents accidental battery drainage.

9. Polarity Switch: Allows switching from "+" to "-" without reve
when measuring DCV or A.
10. dB Chart: Gives correction factors for each range when measurin
6.6 (Decibel Measurements), for more information.

Sec. 5 PREPARATION FOR USE

Sec. 5.1 UNPACKING AND CONTENTS CHECK

The SP-170B comes complete and ready to use. Check the fo
list when unpacking. If any pieces are missing notify the
purchased the instrument from, or A.W. Sperry Instruments

- Operating Instruments Form #179
- Warranty Card
- Test Leads TL-56 one black, one red
- One 9V "Transistor" type battery (NEDA #1604) AWS P
- Two 1.5V "AA" type batteries AWS Part #B-1. See Batte
(section 7.2), for more information.
- Two Fuses (1 Spare) 1/2A, 250V, 6,35mm x 30mm F
AWS Part #F-18. See Fuse Replacement (section 7.3), fo
tion.

Sec. 5.2 PRE-OPERATION PROCEDURE

1. Fill out the enclosed warranty card and mail to AWS w
purchase.

**The following procedure should be followed without fail before ea
use:**

CAUTION

Before attempting to use this meter be certain to read this operatir
thoroughly and completely. Failure to follow these instructions
electrical shock, instrument damage and/or damage to equipmen

2. Inspect the instrument for any external defects by com
diagram on page 3, Fig. 1. If any abnormal conditions exis
to take any measurements. Refer to section 7 (Maintenance
for Repair).
3. Rotate the selector switch one full turn. Check that the s
each of the 24 positions and has no excessive play in each
use if the switch is loose, refer to section 13 (Return for R
4. Inspect the TL-56 test leads for any signs of damage. Check
insulation, broken or damaged probes, loose or bent probe
if any abnormal conditions exist. Refer to section 13 (Retu
purchase a new set from your distributor.

5. Place the SP-170B on a flat horizontal surface. Using a small screwdriver rotate the "Zero Adjust Screw" until the movement pointer lines up with the "0" marking on the left side of the scale plate.
6. Insert the black test lead into the "COM" terminal and the red test lead into the V-Ω-A terminal. Make certain that the leads are seated all the way into the jacks and fit snuggly. If the fit feels loose do not use the SP-170B or test leads. Refer to section 13 (Return for Repair).
7. Place the selector switch on the SP-170B to the "X1" position. Hold the tips of the red and black test leads together and adjust the "0Ω Adj" knob until the movement pointer reads "0" on the ohms scale. The "0" on the ohms scale is located at the extreme top right of the scale plate. If a "0" reading cannot be obtained, a weak battery or blown fuse is the most probable cause. Refer to section 7.2 (Battery Replacement), and 7.3 (Fuse Replacement).

NOTE: The batteries are used for resistance measurements only. The SP-170B can be used in all voltage, current, and dB ranges with a weak, dead, or missing battery.

8. The SP-170B is now ready for use. Follow the measurement procedures (section 6) in this manual for all readings. Read all Safety Precautions in section 6.1 before proceeding.

Sec. 6 OPERATION

Before making any measurements always inspect the instrument and all accessories being used for any signs of damage or defects. Do not attempt to take any measurements if abnormal conditions exist. Instead refer to section 13 (Return for Repairs).

CAUTION

Before attempting to use this meter, be certain to read this operating instruction thoroughly and completely. Failure to follow these instructions may result in electrical shock, instrument damage and/or damage to equipment under test.

Sec. 6.1 SAFETY PRECAUTIONS

1. Read these operating instructions thoroughly and completely before operating your meter. Pay particular attention to WARNINGS and CAUTIONS which will inform you of potentially dangerous procedures. These instructions must be followed.
2. Always inspect your multimeter, test leads and accessories for any sign of damage or abnormality before every use. If any abnormal conditions exist (e.g. broken test leads, cracked cases, movement pointer, sticking, etc.) do not attempt to take any measurements. Refer to section 13 (Return for Repair).
3. Always start with your multimeter set to the highest range of the function to be measured. Never take a measurement if the value of that reading may be greater than the highest range in that function on the multimeter.

4. Do not operate this instrument in an explosive atmosphere (i.e. in the presence of flammable gases or fumes, vapor or dust).
5. Never ground yourself when taking electrical measurements. Don't touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground by using dry clothing, rubber shoes, rubber mats, or any approved insulating material.
6. Never touch exposed wiring, connections or any live circuit conductors when attempting to take measurements.
7. To avoid electric shock use CAUTION when working with voltages above 40Vdc or 20Vac. Such voltages pose a shock hazard.
8. When testing for the presence of voltage, make sure the voltage function is operating properly by reading a known voltage in that range before assuming that a zero reading indicates a no-voltage condition.
9. When measuring motor winding currents, check the multimeter fuse first. An open fuse may allow high voltage build-up, which could be potentially dangerous.
10. Never replace the protective fuse inside the multimeter with any other than the AWS part number specified or approved equal.
11. Calibration and repair should be performed by qualified maintenance personnel only.
12. Do not attempt calibration or service unless another person, capable of rendering first aid and resuscitation, is present.
13. Do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to A.W. Sperry Instruments for service and repair to insure that safety features are maintained.
14. Remember:
    - Avoid Working Alone
    - Think Safety, Act Safely
    - **"DON'T BECOME PART OF THE CIRCUIT"**

Sec. 6.2 HOW TO READ THE SCALE PLATE

The SP-170B scaleplate was designed with you the user in mind. It has large numbers and markings for less eye strain, a mirrored arc to reduce parallax errors, and a minimum number of range arcs to avoid measurement confusion. In order to use your multimeter more effectively please read the following carefully:

1. **Mirrored Arc:** The mirrored arc is provided to reduce measurement error (parallax error). To eliminate these errors from your measurements, position your eyes so that the pointer's reflection in the mirror is hidden behind the pointer and not visible. Then take the reading.
2. **Red AC Arc:** This arc is located 3rd up from the bottom. It is used to read all AC ranges except 2.5Vac. To determine your reading, look at the black number above this arc, the numbers at the extreme right will determine the range (10, 50, 250).

   NOTE: The 50 and 10 arcs become 500 and 1000V respectively when on those voltage ranges.

3. **Red 2.5Vac Arc:** This arc is located 2nd up from the bottom. It is used for the AC 2.5V range only.
4. **Black DC Arc:** This arc is located 4th up from the bottom. It is used to read all DCV and DCA ranges. To determine your readings look at the black numbers below this arc, the numbers at the extreme right will determine the range (10, 50, 250).

   NOTE: The 250 and 50 arcs become 0.25Vdc and 50μAdc respectively when used on those ranges.
5. **Resistance (Ohms) Arc:** This arc is located at the top of the scaleplate. To determine the reading use only the top group of numbers. Take the reading and multiply by the range the switch is set to. For example: On the x1 range a reading of 10 equals 10Ω, on the x100 range a reading of 10 equals 1000 or 1KΩ, and on the x10K range a reading of 10 equals 100KΩ.
6. **Read dB Arc:** This arc is located at the bottom of the scaleplate. To determine the reading use only the bottom group of numbers. Take the reading and add the number of dB corresponding to the ACV range your meter is set to, as indicated on the chart at the bottom right hand corner.

Sec. 6.3 VOLTAGE MEASUREMENTS

1. Follow the Preparation for Use procedure in section 5.
2. Read all Safety Precautions in section 6.1.

CAUTION

1000VAC/DC is the maximum voltage that can be measured using this meter. Attempting to measure higher voltages may result in electrical shock, instrument damage and/or damage to equipment under test.

3. Select an AC or DC voltage range using the selector switch that is higher than the maximum voltage to be measured. If the maximum voltage may be higher than 1000VAC/DC, do not attempt to take a measurement.
4. Apply the test leads to the two points in the circuit at which the voltage is to be measured. When measuring DC voltage, the black lead should be connected to the more negative point of measurement. When measuring AC voltage the polarity does not matter.
5. To read DC voltage use the black "DC" arc directly below the mirrored arc. Use the numbers whose full scale reading matches the range selected by the "selector switch."
6. To read AC voltage (except 2.5VAC) use the red "AC" arc (3rd from bottom) use the numbers directly above whose full scale reading matches the range selected by the "selector switch."

   When using the 2.5VAC range the readings must be taken from the red scale marked 2.5VAC (2nd up from bottom).

Sec. 6.4 DC CURRENT MEASUREMENTS

1. Follow the Preparation for Use procedure in section 5.
2. Read all Safety Precautions in section 6.1.
3. Place the function switch to the 10A position, always start with the highest range.
4. Place the red test lead in the "DC10A" terminal, and the black test lead in the "COM" terminal.

CAUTION

The 10A range is unprotected and has a very low internal resistance. Do not attempt to take a current measurement if the current is unknown or above 10Adc.

WARNING

The instrument must be connected in series with the circuit to be measured. Do not impress voltages across the "COM" and "V-Ω-mA" terminals when set to the mADC ranges. Doing so may result in electric shock, instrument damage and/or damage to equipment under test.

5. Remove power from the circuit to be tested and discharge all capacitors and inductors.
6. Connect the test leads into the circuit so that the meter is in series with the circuit where current is to be measured. The current should enter through the red lead and leave through the black lead in order for the meter to indicate in an "up-scale" direction.
7. Turn on power to the circuit under test. Read the current on the black DC scale and use the full scale numbers which correspond to the range selected (in the case for the 10A range 0-10).

WARNING

Before changing ranges always de-energize the circuit completely. An open circuit exists between the test leads during range change.

8. If the reading is less than 1/2 amp, repeat steps 5 and 6 with the switch set on the 500mA range. Repeat the above procedures until the reading is in the upper half of the scaleplate.
9. Turn off the power to the circuit under test. Discharge all capacitors and inductors. Remove the test leads from the circuit under test, then remove the test leads from the instrument.

Sec. 6.5 RESISTANCE MEASUREMENTS

1. Follow the Preparation for Use procedure in section 5.
2. Read all Safety Precautions in section 6.1.

WARNING

All resistance measurements should be taken on de-energized circuits only. To avoid possible electrical shock, instrument damage, and/or equipment damage, do not connect the "COM" and "V-Ω-A" terminals to any circuit that may not be de-energized. Always be sure to discharge all capacitors.

3. Completely de-energize the circuit or device which is to be measured. Set the selector switch to the range desired. Hold the test lead tips together and adjust for a "0" ohm reading using the "0Ω adj" knob. If a zero reading cannot be obtained, a weak battery is the most probable cause. See section 7.2 (Battery Replacement).
4. Connect the instrument to the points between which the resistance is to be measured. Read the resistance on the uppermost "OHMS" scale. Multiply the reading by the range the selector switch is set to. For example a reading of 10 on the "x10K" range equals 100KΩ (1K = 1000Ω).

NOTE: When reading resistors in circuit, there may exist more than one conductive path. When this condition exists, the reading taken is a combination of the circuit paths. When trying to read one resistor, it is advisable to remove that resistor from the circuit before measurement to avoid reading multiply conductive paths.

Sec. 6.6 DECIBEL MEASUREMENTS

All decibel measurements are taken using the AC voltage ranges. Refer to section 6.3 (Voltage Measurements), for more information on reading AC voltage.

1. Follow the Preparation for Use procedure in section 5.
2. Read all Safety Precautions in section 6.1.

CAUTION

1000Vac/dc is the maximum voltage that can be measured using this meter. Attempting to measure higher voltages may result in electrical shock, instrument damage and/or damage to equipment under test.

3. Set the "selector switch" to the ACV range desired. Be sure that the point to be measured does not contain a voltage higher than the range the instrument is set to. Always check the voltage first, starting with the highest range.
4. Insert the black test lead into the "COM" terminal and the red test lead into the "OUT" terminal.

5. The dB scales can be used to measure the millivolt power dissipation in a 600 ohm load, by measuring the AC voltage across a 600 ohm load. An AC voltage of 0.775 Vrms across 600 ohms is equal to 1mW or "0" dB. When converting an AC voltage to dB, take the dB readings from the lowest arc on the scale plate and then add the appropriate dB correction, as listed in the chart printed in the lower right corner of the instrument scale plate.

Sec. 7 MAINTENANCE

Maintenance consists of periodic cleaning, battery replacement, fuse replacement, and recalibration.

Sec. 7.1 CLEANING

The exterior of the instrument can be cleaned with a soft cloth to remove any oil, grease or grime. Never use any liquid solvents or detergents. Do not polish the instrument. If the instrument gets wet for any reason, dry the inside and outside of the instrument using low pressure air, at less than 25 PSI. Never use pressurized air to dry or clean the movement. If the movement becomes contaminated see section 13 (Return for Repair).

Sec. 7.2 BATTERY REPLACEMENT

The SP-170B has a self-contained power supply consisting of: Two "AA" 1.5V batteries, AWS Part #B-1 and one 9V "Transistor" type battery (NEDA #1604) AWS Part #B-4.

WARNING

Before attempting to replace the batteries, first disconnect the test leads from any energized circuit and then disconnect the test leads from the instrument.

1. Disconnect the test leads from any energized circuit and then from the instrument.
2. Turn the "selector switch" to the OFF position.
3. Remove the two rubber feet from the top of the back case, and carefully place aside.
4. Remove all 3 screws from the back case and take off the cover.
5. To remove all 3 batteries pull up on the free edge of the colored nylon strip. (See Fig. 2).
6. Install the new batteries. Make sure to observe the polarity of the two "AA" type batteries.
7. Replace the back cover, install all three screws and insert the two rubber feet into the top two screw holes.

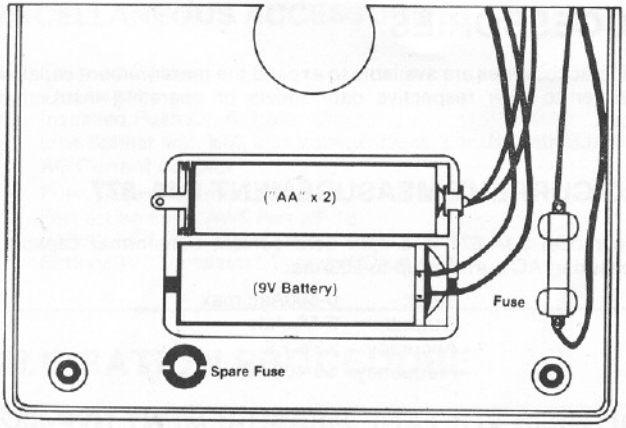


Fig. 2

Sec. 7.3 FUSE REPLACEMENT

A 1/2A, 250V, 5mm x 20mm fast acting high interrupting fuse, (AWS Part #F-7) is installed in the instrument and used to protect the ampere ranges (other than the 10A range) and resistance ranges. Use only AWS Part #F-7 or approved equal.

WARNING

Before attempting to replace the fuse, disconnect the test leads from any energized circuit and then disconnect the test leads from the instrument. Replace the fuse with AWS Part #F-7 or approved equal only. Always use fast acting, high interrupting type fuses.

1. Disconnect the test leads from any energized circuit and then from the instrument.
2. Turn the selector switch to the "OFF" position.
3. Remove the two rubber feet from the top of the back case and carefully place aside.
4. Remove all 3 screws from the back case, and take off the cover.
5. Remove the fuse from the clip next to the batteries. (See Fig. 2).
6. Install the replacement fuse being certain that it meets AWS Part #F-7 specifications.
7. Replace back cover, install all three screws, and insert the two rubber feet into the top two screw holes.

Sec. 8 ACCESSORIES

The following accessories are available to expand the measurement capabilities of the SP-170B. Refer to their respective data sheets or operating instructions for full specifications.

Sec. 8.1 AC CURRENT MEASUREMENT SJA-877

The model SJA-877 is a split core current transformer capable of measuring AC currents up to 500Aac.

Input:	0-500Aac max.
Output:	0-50μAdc
Accuracy:	±3% FS
Frequency:	50-400 Hz

Sec. 8.2 DC HIGH VOLTAGE MEASUREMENT HVP-862-01

The model HVP-862-01 is a high voltage probe capable of measuring DC voltage up to 50,000 Vdc.

Input:	0-50 KVdc
Output:	0-50μAdc
Accuracy:	±1.5% FS

CAUTION

The HVP-862-01 is designed to be used by technicians trained in High Voltage measurement techniques. It is designed for use on high impedance, low energy circuits only. These types of circuits are normally found in electronic equipment. It is not designed to be used on high voltage electrical distribution equipment and circuits. These type of circuits have essentially unlimited energy and special equipment is recommended. DO NOT USE ON THESE TYPES OF HIGH ENERGY CIRCUITS!

Sec. 8.3 TRANSISTOR AND DIODE TEST HFE-840

The model HFE-840 is designed to test de-energized transistors and diodes out of circuit.

Input:	NPN, PNP Transistors, Diodes
Output:	0.5mVdc - 10Vdc
ECB Socket:	For quick easy transistor or diode connection
ECB Jacks:	For supplied test leads

NOTE: The HFE-840 is designed to check de-energized transistors and diodes only.

Sec. 8.4 MISCELLANEOUS ACCESSORIES

C-11A	Carrying Case
TL-56	Test Leads
AG-940	Insulated Push On Alligator Clip
E-1	Line Splitter with x10, and Voltage Jacks. For u AC Current Adaptor
F-18	Fuse, Glass Instrument Type 1/2 A, 250V, 6.35r Fast acting Fuse, AWS Part #F-18
B-1	Battery 1.5V "AA" Type
B-4	Battery 9V "Transistor" Type (NEDA #1604)

Sec. 9 CALIBRATION PROCEDURE

CAUTION

The following procedure should only be performed by qualified in electronics and electronic equipment service. procedure is not qualified.

WARNING

Do not attempt calibration or service unless another rendering first aid and resuscitation, is present.

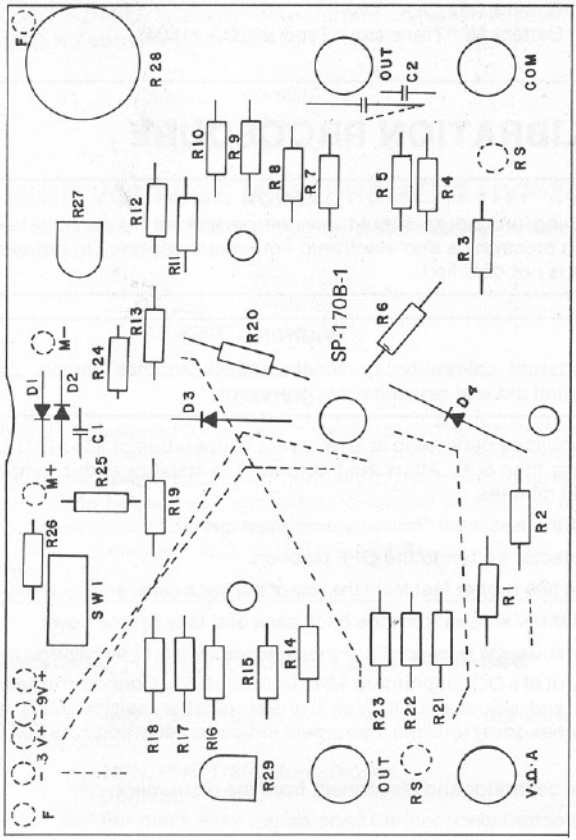
Calibration should be performed at an ambient temperature of humidity of less than 80%. Allow the instrument to stabilize a minimum of 30 minutes.

1. Disconnect the test leads from any energized circuit.
2. Turn the selector switch to the OFF position.
3. Remove the two rubber feet from the top of the back case, a
4. Remove all three screws from the back case and take off th
5. Place the instrument face up. Turn the selector switch to th
6. Set the output of a DC calibrator to +240.0mVdc ±0.5%. Conr instrument and adjust the DC Volt/Current variable resis insulated screwdriver until the instrument indicates 240mVc scaleplate.
7. Turn off the calibrator and disconnect from the instrument.
8. Turn the selector switch to the 10Adc range.
9. Set the output of a DC calibrator to 9.0Adc ±0.5%. Conn instrument and adjust the DC 10A variable resistor (R29) screwdriver until the instrument indicates 9.0Adc ±3% Full

NOTE: If a 9.0Adc supply is not available, a 2.0 Adc ±0.5% supply can be used. Follow step #9 and calibrate the instrument 2Adc ±3% Full Scale.

10. Turn off the calibrator and disconnect from the instrument.

Sec. 10 COMPONENT LAYOUT



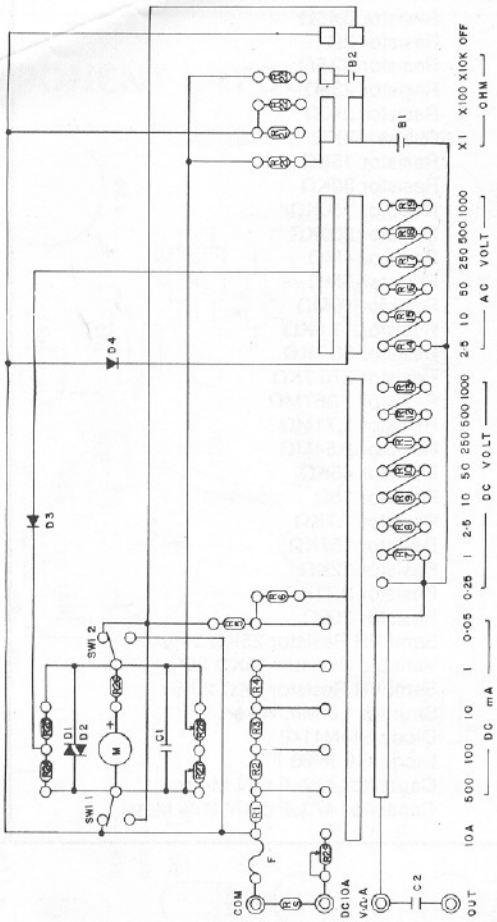
Subsequent revisions to this document may exist.
Use for general references only.

Sec. 11 PARTS LIST

Part #	Description	Size
R1	Resistor 0.48Ω	1/2W WW
R2	Resistor 2Ω	1/2W MF
R3	Resistor 22.6Ω	1/2W MF
R4	Resistor 238Ω	1/4W MF
R5	Resistor 240Ω	1/4W MF
R6	Resistor 3KΩ	1/4W MF
R7	Resistor 15KΩ	1/4W MF
R8	Resistor 30KΩ	1/4W MF
R9	Resistor 150KΩ	1/4W MF
R10	Resistor 800KΩ	1/4W MF
R11	Resistor 4MΩ	1/2W MF
R12	Resistor 5MΩ	1/2W MF
R13	Resistor 10MΩ	1/2W MF
R14	Resistor 11.6KΩ	1/4W MF
R15	Resistor 50.7KΩ	1/4W MF
R16	Resistor 270.7KΩ	1/2W MF
R17	Resistor 1.367MΩ	1/2W MF
R18	Resistor 1.71MΩ	1/2W MF
R19	Resistor 3.54MΩ	1/2W MF
R20	Resistor 45KΩ	1/2W MF
R21	Resistor 15Ω	1/2W MF
R22	Resistor 1.7KΩ	1/2W MF
R23	Resistor 157KΩ	1/2W MF
R24	Resistor 12KΩ	1/2W MF
R25	Resistor 3.71KΩ	1/4W MF
R26	Resistor 200Ω	1/4W MF
R27	Semi VR Resistor 25KΩ 20%	
R28	Variable Resistor 15KΩ 20%	
R29	Semi VR Resistor 5KΩ 20%	
RS	Shunt ϕ 1.6 Mn. Wire	
D1,2,4	Diode SI IN4148	
D3	Diode GE IN60	
C1	Capacitor 472μF 63V Mylar	
C2	Capacitor 473μF 650V 20% Metal	

Subsequent revisions to this document may exist.
Use for general references only.

12 CIRCUIT DIAGRAM



Subsequent revisions to this document may exist.
Use for general references only.

Sec. 13 RETURN FOR REPAIR

Before returning your multimeter for repair be sure to check that the failure to operate properly is not due to the following:

1. Weak battery
2. Open fuse
3. Open, loose, or intermittent test leads

If these conditions do not exist and the instrument fails to operate properly, return the instrument and accessories prepaid to:

A.W. Sperry Instruments, Inc.
Customer Service Department
245 Marcus Blvd.
Hauppauge, N.Y. 11788

State in writing what is wrong with the instrument. All warranty repairs must include proof of purchase in the form of a legible or original copy of the sales receipt, clearly identifying the distributor, model number and date of purchase and must have a warranty card on file. See warranty statement on page 1 for full warranty disclosure. Repair estimate will be furnished if requested for out of warranty instruments. Be sure to include all accessories which may be related to the problem, and a note describing the malfunction you observed.